

PROSPECTUS

OF A

NEW WORK ON PHYSIOLOGY,

ENTITLED:

Natural Philosophy of the Body;

OR,

THE MECHANICS IN

RESPIRATION, CIRCULATION, ABSORPTION, ETC.

BY W. H. TRIPPLETT, M.D.,

Member of the American Association for the Advancement of Science, Etc., Etc.

Box
1341

NEW YORK:

PRINTED BY H. A. VONNEIDSHUTZ, 69 PEARL STREET.

1884.

PROSPECTUS.

HAVING for a number of years been deeply immersed in the study of anatomy and physiology, which I have been inspecting from a fresh standpoint, I am finally prepared to announce something new and startling in this department of science, notably, the existence of

A LAW FOR THE ANIMAL CIRCULATION,

since the matter is proven to demonstration.

But, in order to attain this result, one has need to go beneath the surface of things to the organic laws upon which all living, as well as non-living, matter is based, since everything is founded in immutable law.

And while the scalpel and microscope are essential for revealing the visible circumstances in structure, it is only by experimental tests made with the object of determining the relations which living organisms sustain to special forces in nature, and the fundamental circumstances underlying them, that the problem in animal structure and function may be solved. Founded in the organic laws, the body must have inspection from this standpoint, in order to determine the relation of part to part, and the import of the visible phenomena taking place in it, since there is

systematic arrangement of the structures, while the movements have special significance.

It is also manifest that this requires an extensive acquaintance with vital phenomena, anatomical and physiological, human and comparative; hence, the time consumed in these investigations.

The following brief summary of the contents of this work, together with the Introduction, will give some idea of its scope and comprehensiveness:

PRODUCTION OF CIRCULATION.

Logically, as well as scientifically, the fundamental fact at the basis of living organisms is *the production of a circulation commensurate with the physiological requirements*, or for the purposes of growth and the evolution of force. Otherwise, the building could not go up nor the vital phenomena be evolved; and since

FLORAL UNDERLIES ANIMAL LIFE,

gathering together the nutritive and force-producing elements in air and water, in organic compounds, for feeding and sustaining it, animal life originating no organic compound, it follows that a comprehensive treatment of the animal circulation would naturally include the floral. Furthermore, circulation in bones, cartilages and ligaments, is *analogous with the floral circulation*, while in the soft animal tissues the same principle applies, only that a special arrangement obtains for increasing this action commensurate with the force which is expended in animal life—animal motion and nutrition being widely different things, the one representing accretion, the other effecting dispersion of matter, while the special phenomena which accompany it represent transformations of force. At bottom, therefore, the matter resolves itself into this: What force in nature applies for effecting circulation in flora? when it will be in order to make further inquiry concerning the method adopted for increasing this in fauna commensurate with the force which is expended in them, since force must possess an equivalent in the circulation for maintaining a balance in the organism.

The force for determining the fluids in and out the flora, and for connecting the internal with the external mechanics, is

POLAR FORCE:

the all-pervading principle in matter. By means of this force, which connects the prodigious clockwork through and through, bearing upon every piece in the mechanics, circulation in flora is maintained and regulated under the special provisions existing in nature.

The force is intensified by reason of opposite polarities in the atmosphere and earth, the one being positive, the other negative, while the laws of electrical induction should compel the negative electricity into the limbs and leaflets, and the positive into the rootlets, hence the conditions obtain for producing a current in and out the flora and between the terminal ends.

Physiological experiments made upon the vine in the bleeding season, showing the force in this polar current, *the sap ascending 21 feet above the stump in a glass tube adjusted over it.* This would account for the enormous force which is involved for effecting circulation in mammoth trees, *e. g.,* the giants of California, some of which are over 400 feet in height, and in which tons of sap are kept in constant motion. The effects of temperature and moisture upon this current. Circulation in flora is comparatively slow.

The principle which applies for increasing

CIRCULATION IN FAUNA

commensurate with the force which is expended in them, and for maintaining this in correspondence with the activities, is

THE LAW OF PRESSURE

and the power of producing rapid rhythmical expansions and contractions in the organs for changing pressure, whereby the fluids are *pumped in and through the tissues* for effecting growth and evolving force; said pumping actions being known as respiration and pulsation, peristalsis, etc.; all which relate to *rhythmical changes in pressure*, otherwise they are meaningless.

But for generating force in the body it requires the *simultaneous* introduction of oxygen in the lungs and the force-producing elements in the intestinal canal, since it is by

a chemical combination of the two that force is evolved. This circumstance would explain the inclusion of the chylo-poietic viscera with respiration, and which is accomplished by means of the solar plexus and pneumogastric nerves and the nerves connecting with the spinal axis, for in no other way could a balance be maintained.

The deep underlying fact in animal mechanics is that

RESPIRATION AND CIRCULATION FORM A CONNECTED MOVEMENT

for compelling the commerce in and out of the vessels and through the tissues, while the speed of the currents which is thus produced is dependent upon the rapidity and energy of the pumping actions. The correlation of the three great nervous centres at the base of the brain in the medulla oblongata, namely, respiratory, vaso-motor, and voluntary-motor, has its explanation in this circumstance ; the latter resting upon the other two, for the reason that respiration and circulation must be in correspondence with the activities.

TWO RESPIRATORY MOVEMENTS.

But there are *two* respiratory movements taking place at the same time in the body : one in the lungs, the other in the tissues ; the former for pumping the commerce in the vessels, and the latter for pumping it in and out of the tissues for supplying the cell-brood and removing waste products, while the vascular apparatus, inclusive of the heart, functions as a carrier between these two poles in the circulation, expanding and contracting upon the fluids for compelling circulation to be in correspondence with these actions, and which is known as pulsation ; but the principle is the same, consisting in rhythmical changes in pressure for increasing circulation between the cell-brood and environment. The composite character in arterial tracings, or the existence of respiratory, cardo-arterial, and dicrotic waves, and which are superposed one upon the other in the order named ; or the respiratory by the cardo-arterial, and the latter by the capillary or dicrotic waves, has its explanation in this circumstance, while the actions are co-ordinated in the medulla oblongata. In fine, the pulsations are throbbled over the vessels from this common nervous centre for the organism by means of the nervous plexuses which emboss them.

Traube's curves, together with the physiological problem con-

nected with the curves in arterial and intra-thoracic pressure readily explained.

By means of the law underlying the organism all this is illuminated, and everything is at once made clear and intelligible.

The most incontrovertible evidence of rhythmical expansion and contraction in the arteries and capillaries synchronous with respiration and the action in the heart is exhibited, placing the matter beyond the shadow of a doubt or the possibility of mistake.

THE FORCE IN ATMOSPHERIC PRESSURE.

Physiological experiments showing the force of atmospheric pressure in the body, and that the fluids, as also the contents in the hollow viscera, are compelled to respond to the rhythmical changes in pressure taking place in the organs in connection with the special functions, *pressure being transmitted through and through the body.*

A diagram showing the relations which the venous system sustains to the lungs, and the manner this should be affected by the pumping actions in the chest.

RESPIRATION A DUAL CIRCULATION,

consisting in the *simultaneous* afflux and efflux of air and blood in the alveoli for respiratory purposes, the one passing out by reflux action through the route of ingress, the other passing into the left chambers of the heart and arterial system on its way to the cell-brood.

This would account for the relations which the heart sustains to the lungs, an apparatus for effecting oxygenation of the blood, increasing circulation in it, and compelling this to be in correspondence with the circulation of air in the alveoli, in order to maintain fresh air and venous blood in close proximity for effecting mutual interchange, which the scheme calls for. This *role* in cardiac function would explain the location of the heart at the base of the skull in fishes, since the branchia connect with this portion, while in the case of the frog it is in the common visceral cavity, since the lungs are also here, and it must needs follow them.

This would make the mechanics for oxygenating the blood the cardinal circumstance in the animal organism, and which of course would include arrangements for compelling in the nutritive and force-producing elements in the alimentary canal simultaneously.

The changes in the left side of the heart with progress in development, notably in reptilia and the warm-blooded animals, the left auricle coming in with the former, ~~and the ventricle with the latter~~.

THE RELATIONS WHICH THE LEFT VENTRICLE SUSTAINS TO ARTERIAL PRESSURE

for increasing circulation in the capillaries, enabling these vessels to be filled *instantaneously* the moment they expand.

The mechanical principle in the heart, the same as in a pump, consisting in a *suction* and a *lifting* force combined, the one for aspirating the fluids in the chambers, the other for compelling them out again for producing a current, and which answers to diastole and systole in the organ, *the one being essential to the other*.

The cardiac "inhibitor" a *dilator*, while the "accelerator" is a contractor nerve for the heart. The correlation of these nerves in the medulla oblongata for co-ordinating the action with the pumping movement in the lungs, in correspondence with the exigencies in its functions, is thus made imperative.

Physiological experiments proving incontrovertibly, that

THE "INHIBITOR" IS A CARDIAC DILATOR.

Review of the special phenomena, anatomical and physiological, appertaining to the heart and arterial system, showing correspondence throughout with this principle in cardial and arterial action.

THE MECHANICS IN RESPIRATION.

The lungs and body envelop, expand and contract *simultaneously* in respiration, in order to produce the requisite changes in pressure in the *alveoli*, for compelling *simultaneous* afflux and efflux of air and blood for respiratory purposes, such concert in action being produced by means of the pneumogastric and spinal nerves, and the reflex actions propagated in the medulla oblongata.

The action in the lungs illustrated by respiration in the frog, in which there is neither ribs nor diaphragm, the ribs remaining in an undeveloped condition. Destruction of the throat apparatus in the frog, with final recovery of the animal by closure and cicatrization of the wound. Incontrovertible evidence in the frog of simultaneous rhythmical expansions and contractions of the lungs and muscular envelop in respiration, and which is produced by

means of the pneumogastric and spinal nerves, and the reflex actions propagated in the medulla oblongata, the same as obtains in the higher animals, the rhythms being from 20 to 30 per minute.

Effect upon the portal circulation proven by physiological experiments.

Absolute proof also attainable in the higher animals of this action in the lungs and body envelop, the matter admitting of demonstration.

RESPIRATION IN BIRDS CONTRASTED WITH RESPIRATION IN REPTILIA AND MAMMALIA,

the principle being the same for all the animals, only there is increasing differentiation in the organs with progress in development.

The functions in

RESIDUAL AIR AND ITS MECHANICAL ACTION

in respiration, subserving important ends in this connection by transmitting the force in the muscular envelop to the capillary plexuses, at the same time that it obviates friction and injury to these delicate vessels. This mechanics explained and elucidated. It is charmingly perfect.

By reason of the force which is put upon the blood, in connection with the action in the lungs, inertia is overcome and correspondence established between the circulation of blood and air in the alveoli.

THE ACTION IN THE TRACHEA AND BRONCHI

for increasing circulation in the alveoli and maintaining cleanliness, which is absolutely essential to the functions in the lungs: in cough and expectoration serving to aspirate the alveoli.

The action in vocalization, together with the explanation for the erratic course of the recurrent laryngeal nerves, which *first* descend into the chest to connect with the bronchi, ascending thence upon the *sides of the trachea* to reach the vocal chords, at the same time giving off branches to the tubing for operating the mechanics. This view of tracheal function elucidated by the special anatomy in the organ, together with the special circumstances in lung function which make such active *role* in the trachea and bronchi in respiration an imperious necessity, proving the correctness of the premises.

THE PORTAL CIRCULATION AND THE MECHANICS FOR INCREASING IT, together with the fundamental changes that are ushered in with progress in development, notably :

FIRST.—THE GREAT RELATIVE INCREASE IN SIZE OF THE INTESTINES
IN MAMMALIA,

which are also *filled up and distended with air which is secreted for the purpose*, and by means of which there is not only enormous gain in the mucous surface, but also *free space* in the cavity, in which to effect the churning action for compelling rapid digestion and absorption, while

THE AIR FUNCTIONS AS AN ELASTIC CUSHION

for transmitting the force in the muscular walls of the organ upon the aliment for the purpose. The nerves of Meissner and Auerbach in connection therewith, for producing and unifying the actions by means of sensory impressions in the mucous surface effected by the food, and the manner these nerves connect with the solar plexus and pneumogastric nerves for unifying the actions with respiration.

This mechanics in the intestines would explain *the rapid absorption of non-dialyzable substances*, such as fat, albumen, alcohol etc., which require *mechanical force for compelling them through the animal membranes*, otherwise inexplicable.

SECOND.—THE EXISTENCE OF A DIAPHRAGM

or muscular apron *for restraining the viscera and keeping them in their places*; also for operating them in connection with respiration and the functions in the abdomen. Otherwise they would rise up and produce fatal compression of the lungs, as must appear obvious. Hence, the differentiation of this special organ.

THIRD.—THE EXISTENCE OF PERMANENT HIGH PRESSURE IN THE
GENERAL CAVITY OF THE ABDOMEN,

for maintaining the portal circulation in correspondence with the digestive and absorptive processes, which the scheme calls for, and which is also produced by means of the gases in the intestines and the restraining force in the diaphragm.

This fact proven to demonstration; together with the circumstance that pressure in the abdomen is increased in inspiration

for compelling more rapid afflux of the fluids in the lungs during this time. The action demonstrated in the dog.

The elevation of the diaphragm in the chest-cavity due to intra-abdominal pressure from the presence of the gases in the intestines.

THE PISTON-LIKE ACTION OF THE VISCERA

in the chest-excavation during respiration, for effecting the requisite changes in pressure in the lungs, a fundamental circumstance in the mechanics of respiration and circulation, elucidated by illustrative diagrams showing the relative position of the viscera in birds, mammalia and man, and the changes with progress in development. In birds, for example, in which there is no diaphragm, the pumping action in the abdomen for effecting respiration is quite conspicuous, while concert of action in the lungs and the muscles of the abdomen is produced by means of the pneumogastric and spinal nerves, and the reflex actions propagated in the medulla oblongata, the same as in the frog. The addition of a diaphragm in mammalia, which is called for by reason of the special changes in the intestines as indicated above, works no change of principle in this mechanics, the phrenic nerves for operating the diaphragm in conjunction with the muscles in the abdomen being correlated with the pneumogastric and spinal nerves, whereby perfect concert of action is produced throughout; and the abdominal muscles, being the floor of support to the viscera, the latter must respond to every movement of the former.

The special *role* of the long ligament of the mesentery in this connection, which permits the to and fro movements in the viscera during respiration, vocalization, etc.; also for assisting in compelling the waste products out of the pelvic viscera, and the contents of the womb, the powerful muscles in the abdomen serving to compress the mesentery against the special viscus for the purpose of increasing pressure, while the latter contracts in concert with this action, whereby an effective force is produced for compelling the contents in the environment.

The intimate connection subsisting between the viscera and the spinal cord, and the concentration of nervous force in the medulla oblongata, serving to unify and co-ordinate the actions throughout, while the movable viscera glide readily over each other, sub-

missive to the force in the muscular walls for increasing the local pressure. This mechanics explained and elucidated, with illustrative diagrams of the special anatomy, inclusive of the nervous apparatus for effecting it. It involves a number of beautiful adjustments in the viscera, as also the diaphragm.

The mechanics in emesis.

THE ACTION IN THE KIDNEYS, URETERS AND BLADDER.

The mechanics for increasing circulation in the lymphatics.

Circulation in the embryo, and the principle which obtains in this phase of development.

THE EMBRYO AN AQUATIC ANIMAL,

being submerged in water and deeply buried in the maternal structures, which approximates it to the stages in development represented in the fishes and amphibia. Its circulation and respiration have adjustment with the special environment. It feeds and respires in the placental and uterine sinuses.

PLACENTAL SOUFFLE THE ANALOGUE OF RESPIRATION,

the relative ratio of the movements to the pulsations of the foetal heart being also the same, or as 1 to 4 of the latter.

The action in the womb in connection therewith for increasing circulation in the placenta and embryo.

This action explained and elucidated by illustrative diagrams and the special anatomy.

Incubation : The relation which this sustains to the air-chamber in the egg.

The mode of grafting the ovum in the tissues of the womb.

RESPIRATION IN THE NEW-BORN.

The changes in the haemal mechanics which this involves.

SUB-AQUATIC RESPIRATION IN AIR-BREATHERS,

and the manner in which this is effected.

THE MECHANICS IN EXPANSION AND CONTRACTION,

together with the *dualism* in nervous force hereby necessitated—equilibrium in animal motion *dependent upon the dualism in nervous force.*

HARDNESS AND FIRMNESS IN THE MUSCLES.

The *extraordinary hardness and firmness* which is produced in the muscles by nervous force, and which applies to both flexor and extensor muscles, or to the ones that are elongating with the opposing set that are contracting, the two movements taking place *simultaneously and pari passu with each other*, and which involve dualism in nervous force for effecting it.

THE ACTION IN ERECTILE TISSUE

explained and elucidated, inclusive of the special anatomy and phenomena, and examples drawn from the lower animals.

Striation and fibrillation are methods for increasing energy in the muscles.

TWO GREAT GROUPS OR FAMILIES OF MUSCLES.

Explanation for the two great groups or families of muscles, namely, the non-striated and the striated muscles ; the limitation of the one to the bony skeleton and the organs connected therewith, the other to the vascular system and hollow viscera, inclusive of the exceptions, notably : heart, paunch of the ruminant and bulbous urethrae, in each of which *sudden* and *energetic* action is called for in connection with the special functions in these organs.

To conclude with a chapter on Body-Temperature, and the functions of carbonic acid in the animal organism.

The relation which body-temperature sustains to respiration. An *increase of respiration essential to increase in body-temperature*.

The respiratory centre in one sense a thermal centre. Therapeusis in fever, or the most safe, expeditious and gentle method of reducing and controlling excessive body-temperature.

Carbonic acid a *normal constituent of the blood*, the proportion upon an average being about 30 vols. per cent. for arterial and 35 vols. for venous blood.

Its *role* as a special stimulant to the digestive and nutritive processes ; also serving to maintain a balance in the organism, oxygen being a sedative to the respiratory centre. All natural waters are highly charged with carbonic acid, while water that has been boiled, driving the carbonic acid out of it, is a nauseous dose. The popularity of carbonic acid drinks *has its genesis in the physiological requirements*.

The volume contains 21 chapters and 138 illustrations for im-

pressing the text and bringing out the mechanics in respiration and circulation, beginning with the lowest animal forms in which the body is naked and undifferential protoplasm, but in which, nevertheless, a pumping movement for compelling the fluids in and out of the body for nutritive and respiratory purposes is clearly seen; while the voluntary movements should increase this action in proportion, which is in correspondence with what takes place in the higher animals, the principle being the same. In other words, the pumping movements in respiration and circulation for compelling the fluids to and fro between the cell-brood and environment is in correspondence with the activities, while the fundamental principle underlying it consists in rhythmical changes in pressure, the same as in amoebæ.

But in each and all it involves concert of action between the internal and external parts for producing correspondence throughout, typical illustrations of which are furnished in the leech and frog. For example, in the leech the oesophagus and stomach expand and contract in concert with the action taking place in the external muscular envelop, for producing the characteristic undulations which pass along the body of the animal in imbibition, simulating deglutition; otherwise, it were impossible to produce them; while in the case of the frog the lungs expand and contract synchronous with the action in the external muscular envelop for producing simultaneous afflux and efflux of air and blood in the alveoli for respiratory purposes, otherwise neither respiration nor circulation could be carried on, a circumstance which is amply proven in the text upon the most incontrovertible evidence.

INTRODUCTION.

In the present work fresh ground is broken in biological science, and more of the *knowable* is reduced to demonstration. Indeed, a very considerable gain is hereby added to the present confines.

The method adopted is easy and natural. It consists in seeking out in the living organism the relative adjustments with *special forces* in nature, notably, *pressure and gravitation* (the one referring more particularly to circulation, the other to development).

For example, light calls for the eye or organ of vision for transmitting the sensory impressions produced by it to the brain, and whether this is done by impingement of *waves* of ether against the nervous rods of the retina, or by molecular impact *directly* from the sun itself (as held by Sir Isaac Newton), does not affect the case in the least.

Then, again, if no *vibrations* existed in air and water the ear, or auditory apparatus for transmitting them to the central nervous system, had not been differentiated, nor this have had the relative adjustments with the media in which the animal has its habitat, each calling for special adjustment in this respect.

Coming to the sense of smell, it is perceived that this involves the finest adjustments in which matter, in a state of division almost infinite, propagates its motions to the molecular substance of the brain by means of the olfactory nerves, whereby its presence is made known: a function subserving the highest uses in the struggle for existence, by means of which the prey or vicinage of an enemy is made known.

The sense of touch is another special differentiation in sentient nerves for conveying important knowledge from the outside world to the central nervous system, which need not detain us. The numberless reflex actions upon which the functions in the organs have dependence are referable to this sense.

Finally, and beneath all, lies the *yet deeper* matter of cir-

culation itself, which underlies everything; since it is by circulation only that the nutritive and force-producing elements are supplied, for elaborating the structures and evolving the phenomena.

First floral, then comes animal circulation — *the manner they connect* with the organic laws for determining a current in and out these organisms, in the measure of the physiological requirements, is the problem before us.

The one is accomplished by polar force simply; the other by polar force combined with rapid rhythmical changes in pressure, while the *speed* of the currents thus produced is dependent upon the *rapidity* and *energy* of the rhythmical expansions and contractions taking place in the *trunk*, and pervading the entire organism. In short, startling as it may at first appear, it is nevertheless inatter of actual demonstration, that circulation, respiration and development have *immediate* and *direct* dependence upon pressure and gravitation.

The former acts in *all* directions, while the latter acts in *one only*, or toward the earth.

But since circulation underlies development, furnishing the materials from which structure is elaborated, it is manifest this should have precedence; hence the present work, to which the reader is referred.

This will be followed by a work "On the Relations of Gravitation to Development," in which will be clearly shown the very conspicuous part which gravitation plays in circulation, respiration and the voluntary movements, determining the relative adjustments in the soft tissues and bony framework of support, by means of which the various actions are produced, inclusive of the changes for effecting the *upright* position of the body as in man.

It will thus be seen that this opens up an entirely new line of investigations of an eminently practical nature, and which cannot otherwise but inure to the great benefit of Biology and Medical Science.

The success which has attended this mode of treatment may be judged of by the present work, the multitudinous facts, anatomical and physiological, falling readily and naturally into line in regular order and procession at the proper time and place, and leaving no outstanding quantity refusing absorption, which is absolute proof of the correctness of the premises.

The facts established by vivisections, and other physiological devices, all come under this, being easily explained and harmonized in the general scheme.

In fine, the tangled skein in animal structure and function unravels readily by means of the key which is furnished in the adjustments with special forces in nature, while it is made equally apparent that the mechanics is a much higher order than as reported, the adjustments being truly wonderful.*

In conclusion. This volume could not well be made shorter and still maintain the force of its argument; as it is, the reader's gentle and tender indulgence is asked for on behalf of its but too apparent imperfections. And without occupying still more time in elaboration, it were utterly impossible to have done better, since it is the product of a series of years of unremitting labor, to the exclusion of *every other matter whatsoever*, for this great business in hand. The circumstance, that man at best possesses but a modicum of nervous force, which should not be frittered away, diffused and scattered on miscellaneous objects, but concentrated upon one, is the explanation and justification for this course of action. Then, again, the extreme shortness of life (and intellectual life, which is yet more brief) makes this incumbent; so that he, finding his life-work to do, let him do it with all diligence, and using all the force that in him is, lest Death should come upon him unawares, and the work would be left unfinished.

THE AUTHOR.

* Much pertinent matter is carried over to Part II., "On the Relation of Gravitation to Development," to avoid unnecessary repetition.

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